## SECTION IX

## MISCELLANEOUS APPARATUS/VOLTAGE-SENSITIVE EQUIPMENT/VOLTAGE DROP

Installation of welders, x-rays, or other miscellaneous equipment-particularly as it relates to inrush currents-must be configured in a way that does not impair quality of service to other customers. Before installing such equipment, the customer or contractor is to contact Con Edison to discuss the characteristics of the service to be supplied and the proper method for connecting equipment.

For welders, x-rays, and other inherently single-phase apparatus requiring inrush current in excess of the values allowed by Con Edison, the customer must provide rotating equipment for converting from three-phase to single-phase operation or other equipment such as capacitors-to reduce inrush current to an acceptable value. Instead of providing current-limiting equipment, the customer may request Con Edison to provide excess distribution facilities. See Section IV, “Service Connections”.

Where miscellaneous appliances-such as furnaces, heaters, and ranges-with 120-volt elements are supplied from 3 or 4-wire services, the elements must be connected between the line wires and the neutral in a manner that maintains minimum operating current imbalance.

Since no utility can guarantee against occasional service failures or voltage irregularities, it is important that prior to installing electrical equipment/appliances, the customer is strongly advised to consult with Con Edison on service characteristics and/or limitations, as well as with consultants and/or equipment manufacturers to determine the most effective methods of protecting such equipment from service interruptions, reduced voltage issues, etc. The following few pages provides for some general recommendations and guidelines.

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### Voltage Drop

The installation of the electric system for the customer structure can be designed by the licensed electrician for the allowable voltage drop for Branch circuits, conductors, and Feeders as per Articles 210, 310, and 215 respectively in the NEC code. In regards to sensitive electronic systems, they can be designed by the licensed electrician for the allowable voltage drop as per NEC Code Article 647. However, consideration should be made when designing such system to compensate for the lowest voltage supplied by Con Edison during a contingency event.

Switchboards and panel-boards will function with steady state voltage variations other than the standard normal rating with minimal effect to the equipment. Utilization equipment, such as high-density lighting, computer-data equipment and motors, may malfunction or be severely damaged by under-voltage conditions. The customer is responsible and must follow the manufacturer's instructions that are included with the listing and labeling of the product. It is recommended that the customer, in conjunction with the equipment manufacturer, establish protective relay settings which take into account the company's contingency parameters.

It is further recommended that the customer take the necessary steps to protect any voltage sensitive equipment. Depending upon the criticality of the equipment, the customer may elect to install an Uninterrupted Power Supply System (UPS).

Electric power outages or voltage irregularities can occur due to extremely hot weather, strong thunder storms, hurricanes, blizzards, or significant events. The communication provided is to explain how Con Edison attempts to balance load, prevent volt fluctuation from harming customer equipment including buffering devices, line voltage regulator and transient voltage surge suppressors.

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### Steady-State Voltage

The following steady-state voltage variations can occur on the Con Edison system during normal condition and during infrequently - occurring contingencies.

| Type | Measure | Normal | Contingency |
|---|---|---|---|
| 120/208-volt<br>3-phase 4-wire | Phase to neutral<br>Phase to Phase | 126-118<br>218-205 | 126-108<br>218-187 |
| 120/240-volt<br>1-phase 3-wire | Phase to neutral<br>Phase to Phase | 126-118<br>252-236 | 126-108<br>252-216 |
| 265/460-volt<br>3-phase 4-wire | Phase to neutral<br>Phase to Phase | 278-260<br>481-450 | 278-250<br>481-433 |

### Transient voltage fluctuations

Power transients (voltage spikes or dips) may be caused by utility switching operations, cable or equipment faults or the turning or off of heavy customer loads. Experience shows that most transients are dips, and that the majority of transients have no adverse effect on most types of electrical equipment. However, depending on their severity and duration, some transients could cause service interruptions or malfunctions in computers and other sensitive electronic equipment which is not protected by adequate buffering equipment.

The following tables list the values to which service voltage could dip on the 120/208 and 265/460-volt network systems. Service voltage is measured at the point where Con Edison supply lines connect to the customer's electrical lines (the point of service termination).

These are the voltage dips which could occur on the 120/208-volt network system, with their average durations and frequencies:

| Voltage dips From 120 Volt | Duration | Average Frequency of Occurrence |
|---|---|---|
| To 90 volts (25%) month | 06 cycles (100ms) | Once or twice per |
| To 90 volts (25%) year | 30 cycles (500ms) | Once or twice per |
| To 55 volts (54%) year | 12 cycles (200ms) | Once or twice per year |
| To 00 volts (54%) year | 12 cycles (200ms) | Very rare |

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These are the voltage dips which could occur on the 265/460-volt network system, with their average durations and frequencies:

| Voltage dips From 265-Volt | Duration | Average Frequency of Occurrence |
|---|---|---|
| To 199 volts (25%) month | 06 cycles (100ms) | Once or twice per month |
| To 199 volts (25%) year | 30 cycles (500ms) | Once or twice per year |
| To 121 volts (54%) year | 12 cycles (200ms) | Once or twice per year |
| To 0 volts (54%) year | 12 cycles (200ms) | Very rare |

Additional voltage drops may occur within the customer's premises, depending on the adequacy and characteristics of the customer's own distribution lines, and the amount of electrical load served by these lines. These additional drops could reduce equipment input voltage to unacceptable levels even if a utility service transient is so slight that it would not normally cause problems.

### Balancing Loads

To ensure better voltage regulation, it is important to balance the electrical load in an installation among the 3-phase lines on all supply risers.

### Equipment Grounding

Proper equipment grounding reduces the susceptibility of the equipment to internally or externally - generated electrical disturbances which could distort the supply voltage.

### Buffering Equipment

Properly selected buffering devices can reduce or eliminated the effect of transient voltage fluctuations on sensitive electronic equipment.

### Line Voltage Regulator

This equipment maintains steady-state voltage within desired operating limits riding through transient voltage disturbances of short duration.

### Transient Voltage Surge Suppressors

These solid state devices prevent transient disturbances (spikes from penetrating the supply lines or the sensitive electrical equipment without reducing the line voltage below its steady-state value.